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10/561,395	12/19/2005	Dirk Meier	MEIER9	6142

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WASHINGTON, DC 20001-5303

EXAMINER
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KIM, KIHO

ART UNIT	PAPER NUMBER
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2809

MAIL DATE	DELIVERY MODE
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09/26/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/561,395

Applicant(s)

MEIER ET AL.

Examiner

Kiho Kim

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 19 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 11-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 December 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 12/19/2005
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Specification***

1. The disclosure is objected to because of the following informalities:
  - "8mm" (line 29, p. 13) should be "8 mm" (with a space).
  - "4mm" (line 29, p. 13 ) should be "4 mm" (with a space).
  - Two of "64mm" (line 30, p. 13) should be "64 mm" (with a space).
  - "6mm" (line 1, p. 14) should be "6 mm" (with a space).
  - "300 $\mu$ m" (line 1, p. 14) should be "300  $\mu$ m" (with a space).
  - "600 $\mu$ m" (line 2, p. 14) should be "600  $\mu$ m" (with a space).

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 22 and 23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Because it is not clear that what "an axis of the ring structure" is.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 11, 12, 16, 18, and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Pat. No. 6,583,420 B1 to Nelson et al. (Hereafter Nelson.)

Re: Claim 1

Nelson teaches a detector module (102 in Fig. 1; col. 6, lines 48 – 54) for detecting depth-of-interaction (taught as “attenuating” on line 14 in abstract) of discrete photons, the detector module comprising:

a scintillator array (Nelson discloses in col. 7, line 49 – 61 that a number of array geometries, in addition to the standard planar detector array format, can be utilized. In col. 7, line 53, Nelson discloses a plurality of “scintillator,” inherently teaching a scintillator array) having a plurality of scintillator elements each accessible (as seen in Fig. 1, scintillators are accessible from the array.) from a surface of the scintillator array and adapted to produce light upon absorbing a photon;

a photodiode array (In col. 5, lines 23 - 24 and col. 7, line 53, Nelson teaches as semiconductor detectors of avalanche photodiodes optically coupled to scintillators.) having a like plurality of photodiode elements each having an active surface disposed parallel (In col. 7, line 53 Nelson teaches semiconductor detectors coupled to

scintillators. Fig. 1 indicates this limitation.) to said surface of the scintillator array and optically coupled (In col. 5, lines 22 – 23) to a corresponding scintillator element of the scintillator array for receiving said light and producing a respective electrical signal; and

an electronic circuit (taught as a communication link 103 in Fig. 1 as well as a base containing detector electronics, power management components, temperature control components and a data or information channel; Col. 6, lines 53 – 54) that is electrically coupled (as seen in Fig. 1) to the photodiode array for receiving and processing said electrical signals;

the scintillator array comprising multiple scintillator elements along each axis of a two-dimensional matrix (In col. 5, line 22 – 23, Nelson discloses small two-dimensional semiconductor arrays optically coupled to scintillators. This inherently teaches this limitation.) and being configured so that, in use, an incident photon strikes an edge normal to said surface of the scintillator array (Nelson teaches this in Fig. 1 by reference numeral 107 and in col. 6, lines 42 – 43) and propagates through successive scintillator elements until it is at least partially absorbed thus transferring at least some of its energy to a pixel of the photodiode array and providing depth-of-interaction (Col. 5 lines 43 – 45) of the photon. (The same phenomenon occurs in the Nelson's detector module).

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In col. 6, line 53 and 106 in Fig. 1, Nelson teaches "a carrier" as "a base" for supporting the photodiode array and the electronic circuit.

Re: Claim 16

Nelson discloses in col. 2, lines 49 – 52 a source that has one or more emission energies of a narrow energy bandwidth. Therefore, Nelson inherently teaches the discrete photons have substantially identical energies.

Re: Claim 18

Nelson shows two-stacked modules in Fig. 2a and discloses them in col. 8, lines 42.

Re: Claim 20

Nelson teaches in col. 7, lines 62 – 65 that the increased detector density (a composite detector assembly comprising two or more detector assemblies) is useful for enhancing the imaging of select regions of the subject, particularly suited to form large area. (The array 1000 illustrated in Fig. 1 is particularly suited to form the large area, 2-D detector arrays.)

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***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson as applied to claim 12 above, and further in view of U.S. Pat. No. 6,194,726 to Pi et al. (Hereafter Pi.)

Re: Claim 13

The teaching of Nelson has been discussed above.

Nelson is silent with a base formed of ceramic material.

Pi teaches in col. 8, lines 59 – 60 a carrier made of ceramic material.

It would have been obvious to those ordinary skilled in the art at the time of the invention was made to modify the detector module of Nelson with a ceramic base as taught by Pi in order to have a proper heating sinking element in the detector module, to produce high quality AC coupling to the detector module or to have a rigid support or to provide physical protection for the crystals. (Col. 13, lines 11 – 19)

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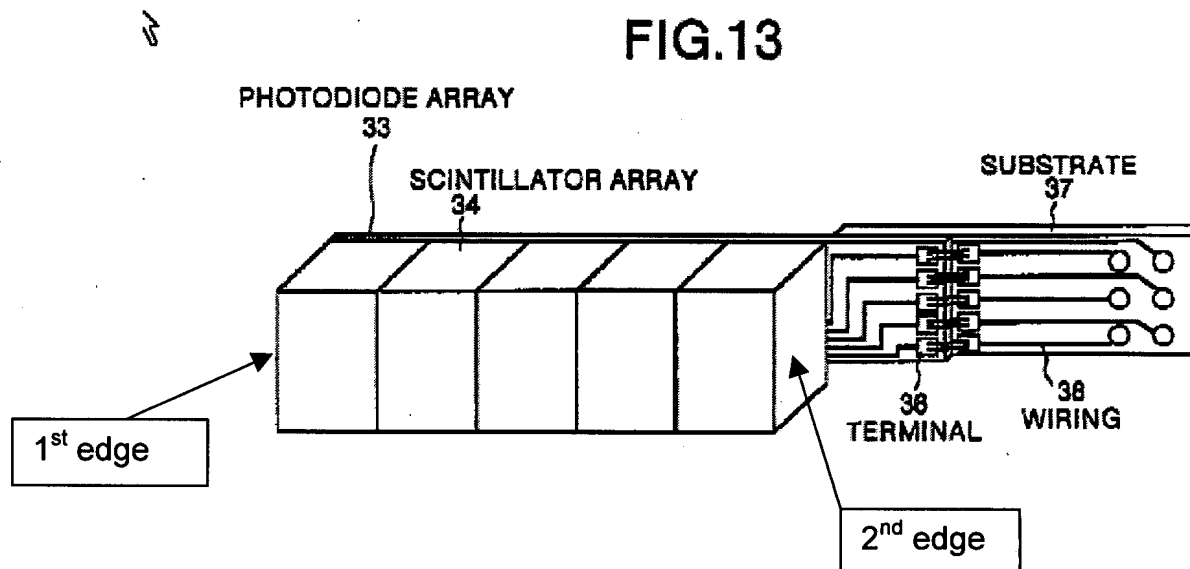
5. Claims 14, 15, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson as applied to claim 12 above, and further in view of Sekine et al. (U. S. PGPub 2002/0153492 A1)

The teaching of Nelson has been discussed above.

Re: Claims 14 and 15

Nelson fails to teach or reasonably suggest that the electronic circuit is mounted on the carrier so as to abut a second edge of the scintillator array opposite to the first edge thereof and; sink is mounted on top of the electronic circuit in thermal contact therewith so that the electronic circuit is sandwiched between the carrier and the heat sink.

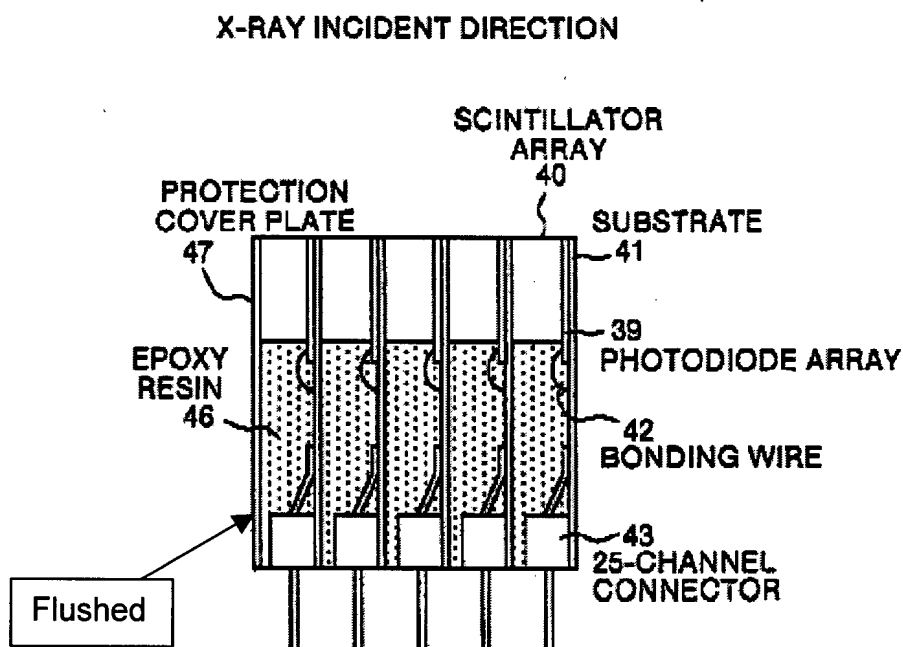
In Fig. 13, Sekine shows (and therefore teaches) the electronic circuits mounted on the carrier so as to abut a second edge of the scintillator array.





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Also, In Fig. 15B (see Fig. 15 B below), Sekine shows (and therefore teaches) epoxy resin filled into the space (paragraph [0088], p. 8, lines 2- - 21) section thereof so that an upper surface thereof is flush with an upper surface of the scintillator array. It is recognized as obvious by artisans in the art that epoxy resin acts as a heat sink. Also, Fig. 15 B indicates that the electric circuit is sandwiched between the carrier and the heat sink. Fig. 15B illustrates the "flushing"

**FIG.15B**

It would have been obvious to those ordinary skilled in the art at the time of the invention was made to incorporate electric circuit and epoxy resin filled into the space to flush with an upper surface of the scintillator array as taught by Sekine to the teaching

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of Nelson in order to provide a means of removing unwanted heat in the detectors and to add more rigidity to the detectors.

Re: Claim 19

Nelson fails to teach overall thicknesses of the scintillator array, the photodiode array and the carrier.

Sekine discloses in paragraph [0088] that a thickness of photodiode array is 0.3 mm, a thickness of the scintillator array is 2.19 mm, and a thickness of a substrate (which is the same as the carrier) is 0.2 mm. Therefore, Sekine teaches a combined thickness of the carrier and the photodiode array is less than a thickness of the scintillator array thereby reducing dead space between adjacent detector modules that is insensitive to incoming photons.

It would have been obvious to those ordinary skilled in the art at the time of the invention was made to incorporate the thicknesses suggested by Sekine for the scintillator array, the photodiode array, and the carrier to the teaching of Nelson because the thickness of the material is so important so as to increase the sensitivity of radiation detection systems. (See paragraph[0006].)

6. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson modified by Sekine as applied to claim 16 above, and further in view of Nygard et al.

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(U.S. PGPub 2002/0145115 A1, hereafter Nygard.)

The teaching of Nelson modified by Sekine has been described above.

The combined teaching of Nelson modified by Sekine is silent with the energy of each discrete photon is substantially 511 keV.

Nygard teach (in paragraph [0006]) the incident gamma radiation energy at 511 keV.

It would have been obvious to those ordinary skilled in the art at the time of the invention was made to incorporate the gamma radiation energy at 511 keV as taught by Nygard to the teaching of Nelson modified by Sekine in order to relatively-easily find the location of a tumor using a PET or SPECT system. (paragraph[0006])

7. Claims 21 - 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson modified by Sekine, and further in view of U.S. Pat. No. 6,194,726 to Pi et al. (Hereafter Pi.)

Re: Claim 21

The teaching of Nelson has been discussed above.

The combination of the teaching of Nelson modified by Sekine fails to teach or reasonable suggest the detector module arranged in a ring structure.

Pi teaches in col. 14, lines 30 – 33 the detector modules are arranged in an annular ring.

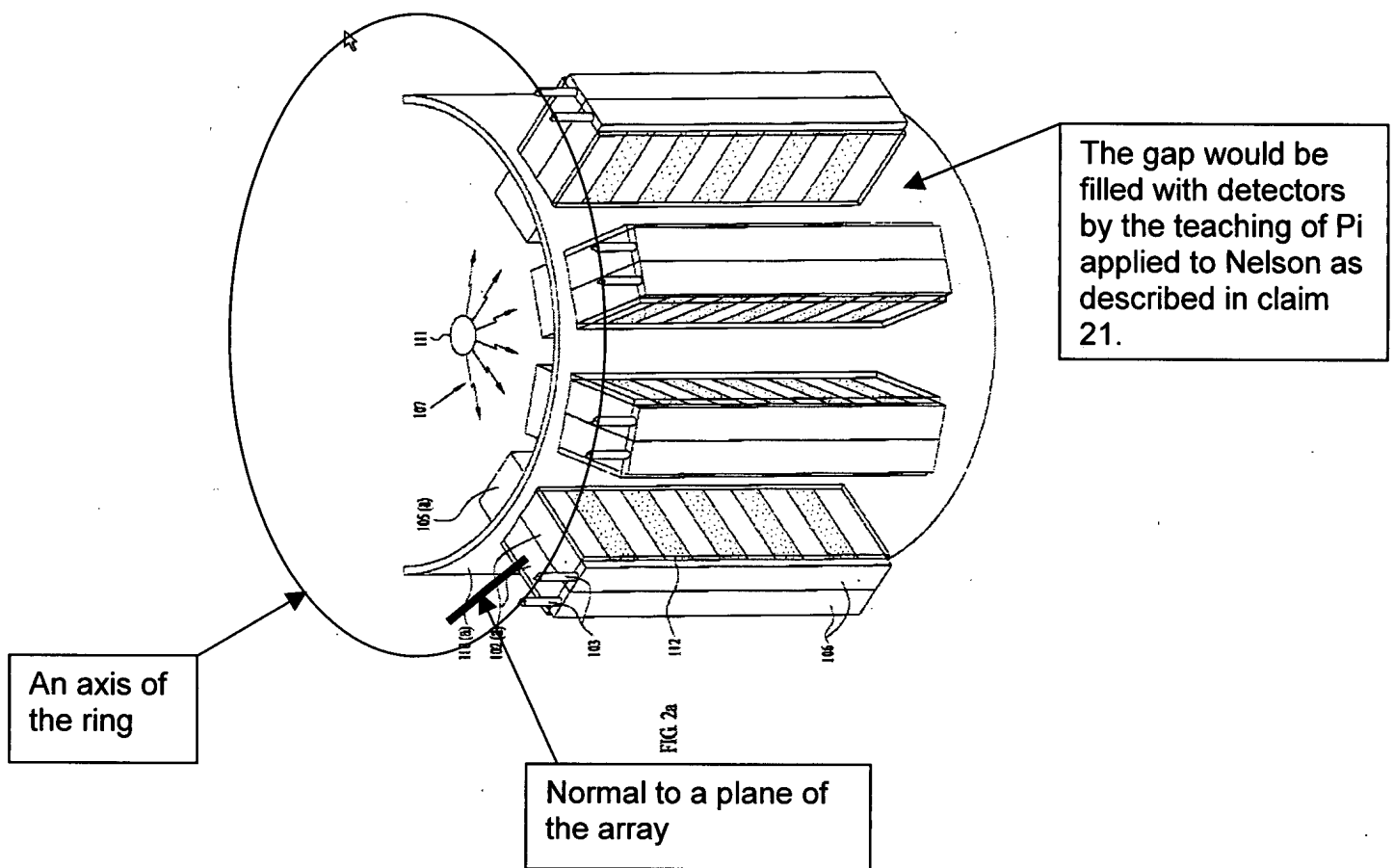
It would have been obvious to those ordinary skilled in the art at the time of the invention was made to modify the teaching of Nelson modified by Sekine with the

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detector module arranged in a ring structure as taught by Pi in order to meet specific requirements in designing particular PET systems.

Re: Claim 22

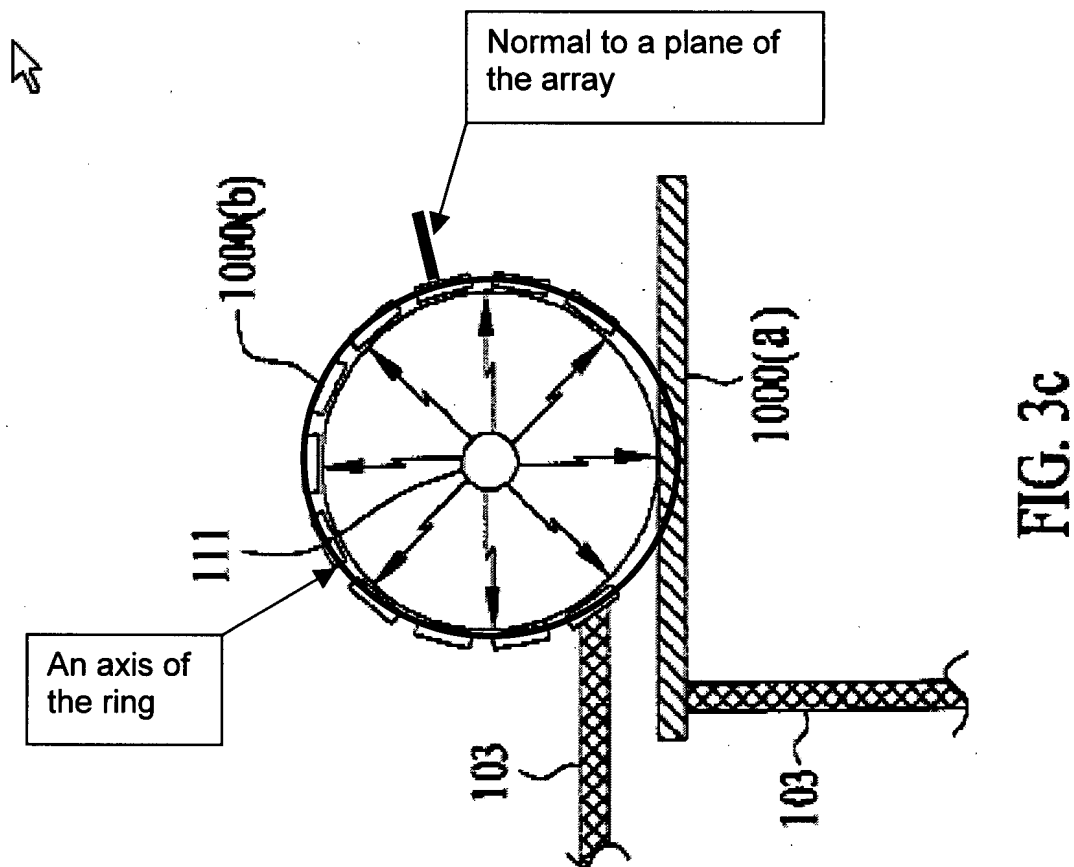
Nelson's scanner modified by Pi to a ring structure can be shown like the one in Fig. 2a (of Nelson). In Fig. 2a (col. 8, lines 42 – 52), the detector assemblies of Nelson modified by Pi are orientated such that a normal through a plane of the scintillator array is collinear with an axis of the ring structure.



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Re: Claim 23

Nelson's scanner modified by Pi to a ring structure can be shown like the one in Fig. 3c (col. 9, lines 15 – 26). Then the detector assemblies of Nelson modified by Pi are orientated such that a normal through a plane of the scintillator array is orthogonal to an axis of the ring structure.



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Re: Claim 24

Nelson discloses PET in col. 1, line 24 and therefore, Nelson's scanner modified by Pi is configured for PET tomography.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. In addition to the prior art cited above, Hoffman, Giakos, and Von Der Haar were under reviewed upon examining this application.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kiho Kim whose telephone number is (571)270-1628. The examiner can normally be reached on Monday - Friday 8:00 a.m. - 5:00 p.m. EST.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kimberly Nguyen can be reached on (571)272-2402. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Examiner's note: Examiner has cited particular column and line numbers in the references as applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to the specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the examiner.

/K.K./



Kiesha L. Rose  
Primary Examiner  
Sept. 20, 2007